

සියලු ම හිමිකම් ඇවිරිණි/முழுப் பதிப்புரிமையுடையது/All Rights Reserved

පැරණි නිර්දේශ/பழைய பாடத்திட்டம்/Old Syllabus

OLD  
Sri Lanka Department of Examinations, Sri Lanka  
இலங்கைப் பரீட்சைத் திணைக்களம், Sri Lanka Department of Examinations, Sri Lanka

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2019 අගෝස්තු  
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2019 ஆகஸ்ட்  
General Certificate of Education (Adv. Level) Examination, August 2019

කර්ක ශාස්ත්‍රය හා විද්‍යාත්මක ක්‍රමය I  
அளவையியலும் விஞ்ஞானமுறையும் I  
Logic and Scientific Method I

24 E I

07.08.2019 / 1300 – 1500

පැය දෙකයි  
இரண்டு மணித்தியாலம்  
Two hours

### Instructions:

- \* Answer *all* questions.
- \* Write your *Index Number* in the space provided in the answer sheet.
- \* Instructions are given on the back of the answer sheet. Follow those carefully.
- \* In each of the questions 1 to 50, pick one of the alternatives from (1), (2), (3), (4), (5) which is *correct or most appropriate* and mark your response on the answer sheet with a cross (x) on the number of the correct option in accordance with the instructions given on the back of the answer sheet.
- \* Each question carries 02 marks making a total of 100 marks.

### N.B.

- \* Logical constants used in this paper are the following:

Negation:  $\sim$ , Implication:  $\rightarrow$ , Conjunction:  $\wedge$ , Disjunction:  $\vee$ , Biconditional:  $\leftrightarrow$

Universal quantifier :  $\forall$ , Existential quantifier :  $\exists$

1. Two of the factors in the Aristotelian analysis of a proposition are
  - (1) premises and conclusions.
  - (2) truth and validity.
  - (3) particular and singular.
  - (4) subject and predicate.
  - (5) function and argument.
2. The deviations from a circular orbit of the observed positions recorded by Tycho de Brahae of the motion of one of the following planets guided Kepler to the discovery that planetary orbits are elliptic. That planet was
  - (1) Jupiter.
  - (2) Venus.
  - (3) Mars.
  - (4) Mercury.
  - (5) Uranus.
3. A sound deductive argument is
  - (1) a valid argument.
  - (2) an invalid argument with a true conclusion.
  - (3) a valid argument with false premises.
  - (4) an invalid argument with true premises.
  - (5) a valid argument with true premises.
4. In scientific methodology, an empirical test is
  - (1) an observation.
  - (2) an experiment.
  - (3) an observation or an experiment.
  - (4) an experiment with measurement.
  - (5) an observation followed up with experiment.
5. Of the sentences given below, what could be considered a simple categorical proposition in traditional Logic?
  - (1) He is a Sri Lankan or an Indian.
  - (2) If anyone is a Sri Lankan, then he can come.
  - (3) No Sri Lankan was the Secretary General of the United Nations Organization.
  - (4) Did Socrates drink the poison?
  - (5) Jack and Jill went up the hill.

6. Which of the following could be considered a natural observation?
- (1) Kepler's observation that the orbit of a planet around the Sun was elliptic.
  - (2) Lavoisier's observation that the weight of an object after combustion increases.
  - (3) Galileo's observation through his telescope that the surface of the Moon is uneven.
  - (4) John Dalton's observation that elements combine in small ratios by weight to form compounds.
  - (5) John Waston's seeing the X-ray diffraction pattern of DNA molecule produced by Rosalind Franklin as that of a 'double helix'.
7. The obverse of the sentence, 'All shrimps are non obtainable today' is
- (1) Some shrimps are not obtainable today.
  - (2) All non-obtainable things today are shrimps.
  - (3) No shrimps are obtainable today.
  - (4) Some non-obtainable things today are shrimps.
  - (5) Some shrimps are obtainable today.
8. Which of the following measurements could or does use a ratio scale?
- (1) Testing a person's knowledge of French
  - (2) The Intelligence Quotient (IQ) of a person
  - (3) Length
  - (4) Temperature in °C or °F
  - (5) Term test assessment of a student's marks in the class
9. The syllogism "All Sri Lankans are Aryans. Some Indians are Aryans. Therefore some Sri Lankans are Indians."
- (1) is a valid argument.
  - (2) commits the fallacy of the illicit major.
  - (3) commits the fallacy of the illicit minor.
  - (4) is a sound argument.
  - (5) commits the fallacy of the undistributed middle.
10. The colours in the rainbow, X-rays, infra-red rays, ultra-violet rays and gamma rays are all
- (1) white light.
  - (2) gravitational waves.
  - (3) invisible light.
  - (4) electromagnetic radiation.
  - (5) radio waves.
11. Which of the following pairs of propositions in the traditional square of opposition has a **non**-symmetric relation between its two members?
- (1) A and E
  - (2) A and O
  - (3) A and I
  - (4) E and I
  - (5) O and I
12. The binomial nomenclature using two names to classify organisms based on genus and species was a major contribution to taxonomy by
- (1) Jean-Baptiste Lamarck.
  - (2) Charles Darwin.
  - (3) Carolus Linnaeus
  - (4) Alfred Wallace.
  - (5) Antoine Van Leeuwenhoek.
13. Which of the following statements about 'conversion' is true?
- (1) The converse of an I proposition is an O proposition.
  - (2) The converse of an A proposition is an A proposition.
  - (3) The converse of an O proposition is an A proposition.
  - (4) The converse of an I proposition is an I proposition.
  - (5) The converse of an E proposition is an A proposition.
14. In a complete induction by enumeration if the premises are true then the conclusion is
- (1) true.
  - (2) probable.
  - (3) invalid.
  - (4) uncertain.
  - (5) possibly true.

15. The sentence,  
'It is false that if it rains the Mahaveli overflows.' and  
The sentence,  
'It rains and the Mahaveli does not overflow.' are  
(1) contradictory. (2) not logically related.  
(3) logically equivalent. (4) contrary.  
(5) neither equivalent nor contrary.
16. Nanometre and the light year can be, respectively, best used for giving the measures of  
(1) size of bacteria and dinosaurs.  
(2) wave lengths of audible sound and the speed of a car.  
(3) atomic distances and intergalactic distances.  
(4) sizes of micro-organisms and velocity of sound.  
(5) speed of rotation of Earth about its axis and distances of Saturn from Earth as both orbit the Sun.
17. If  $A, B$  are non-empty classes and  $A\bar{B} = \phi$ , then  
(1)  $\bar{A}\bar{B} \neq \phi$  (2)  $\bar{A}B \neq \phi$  (3)  $\bar{A}\bar{B} = \phi$  (4)  $AB \neq \phi$  (5)  $AB = \phi$
18. How many different sets of three cards can be dealt from a pack of 52 cards?  
(1) 17850 (2) 20658 (3) 22100 (4) 126000 (5) 221225
19. Which of the following is the correct truth-tree for the argument  $(P \vee \sim Q) \cdot (P \rightarrow R) \therefore (Q \rightarrow R)$ ?
- $(P \vee \sim Q)$   
 $(P \rightarrow R)$   
 $\sim(Q \rightarrow R)$   
 $Q$   
 $\sim R$   
 $\swarrow \quad \searrow$   
 $\sim P \quad \sim R$   
 $\swarrow \quad \searrow \quad \swarrow \quad \searrow$   
 $P_x \quad \sim Q_x \quad P \quad \sim Q_x$

(1)

$(P \vee \sim Q)$   
 $(P \rightarrow R)$   
 $(Q \rightarrow R)$   
 $Q$   
 $R$   
 $\swarrow \quad \searrow$   
 $\sim P \quad R$   
 $\swarrow \quad \searrow \quad \swarrow \quad \searrow$   
 $P_x \quad \sim Q_x \quad P \quad \sim Q_x$

(2)

$(P \vee \sim Q)$   
 $(P \rightarrow R)$   
 $(Q \rightarrow R)$   
 $Q$   
 $\sim R$   
 $\swarrow \quad \searrow$   
 $\sim P \quad R_x$   
 $\swarrow \quad \searrow \quad \swarrow \quad \searrow$   
 $P_x \quad \sim Q_x \quad P \quad \sim Q_x$

(3)

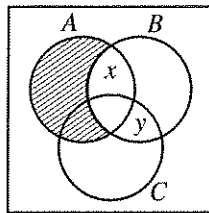
$(P \vee \sim Q)$   
 $(P \rightarrow R)$   
 $\sim(Q \rightarrow R)$   
 $Q$   
 $\sim R$   
 $\swarrow \quad \searrow$   
 $\sim P \quad R_x$   
 $\swarrow \quad \searrow \quad \swarrow \quad \searrow$   
 $P_x \quad \sim Q_x \quad P \quad \sim Q_x$

(4)

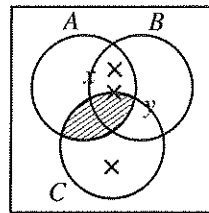
$(P \vee \sim Q)$   
 $(P \rightarrow R)$   
 $\sim(Q \rightarrow R)$   
 $Q$   
 $\sim R$   
 $\swarrow \quad \searrow$   
 $\sim P \quad R$   
 $\swarrow \quad \searrow \quad \swarrow \quad \searrow$   
 $P_x \quad \sim Q_x \quad P \quad \sim Q_x$

(5)
20. X's household needs 1 kg of sugar, 5 coconuts, 5 kg of rice, 2 kg of dhal and 3 l (litres) of milk for the week. The prices of these items during two successive weeks were as follows.
- |            | Price: 1 <sup>st</sup> week (Rs.) | Price: 2 <sup>nd</sup> week (Rs.) |
|------------|-----------------------------------|-----------------------------------|
| Sugar 1 kg | 100                               | 110                               |
| Coconut    | 50                                | 45                                |
| Rice 1 kg  | 90                                | 100                               |
| Dhal 1 kg  | 150                               | 160                               |
| Milk 1 l   | 200                               | 220                               |
- If only these factors are counted in the calculation of the cost of living index, the ratio by which the cost of living index has changed in the second week to two decimal places is  
(1) 0.95 (2) 1.07 (3) 1.10 (4) 1.16 (5) 1.19
21. In the sentence, 'A few men were non-smokers.'  
(1) the subject is distributed  
(2) no term is distributed.  
(3) only the predicate is distributed.  
(4) both subject and predicate are distributed.  
(5) the distribution of the terms cannot be determined.
22. Who, among the following scientists, was the outstanding scientist that used innovative, instructive and lasting methods to provide solutions to the immediate problems of life and occupation which his society in general, was facing?  
(1) Isaac Newton (2) Charles Darwin  
(3) Alexander Fleming (4) J.C. Bose  
(5) Louis Pasteur

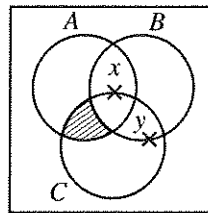
23. If  $A, B, C$  are classes and  $x, y$  are class members and  $AB \neq \phi, AC = \phi, \bar{B}C \neq \phi, x \in A$  and  $y \in B$ , then Venn diagram which represents these correctly is



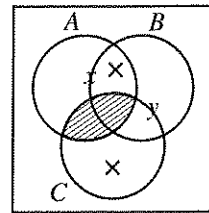
(1)



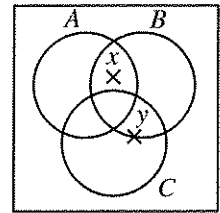
(2)



(3)



(4)



(5)

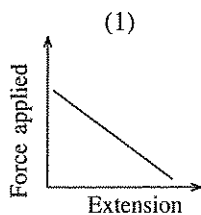
24. The methodologists of science who had been influenced by B.L. Whorf's idea that language has an effect on the world view of a community were

- (1) Inductivists. (2) Empiricists. (3) Deductivists.  
(4) Relativists. (5) Positivists.

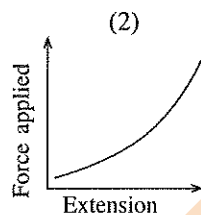
25. Which set of the following characteristics properly apply to the syllogism, "All Pakistanese speak Urdu. All Sinhalese do not speak Urdu. Therefore, no Sinhalese are Pakistanese"?

- (1) Figure 1, AAE, valid (2) Figure 2, AEE, valid  
(3) Figure 3, AOE, invalid (4) Figure 4, AOE, valid  
(5) Figure 2, AOE, invalid

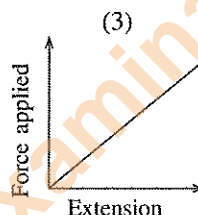
26. Hooke's law says that (within certain limits) the extension of a spring or wire is directly proportional to the force applied. When a graph of the force applied against the extension is plotted, which of the following would the graph appear to be?



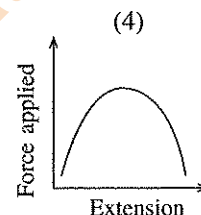
(1)



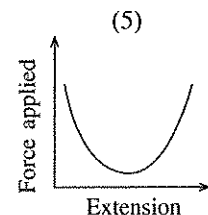
(2)



(3)



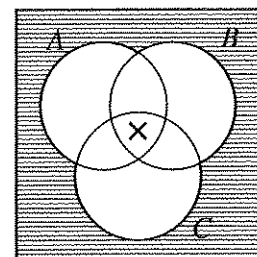
(4)



(5)

27. The three classes  $A, B, C$  shown in the diagram are such that

- (1) some of them are null.  
(2) none of them are null.  
(3) together, they do not exhaust the universe of discourse.  
(4) whether the classes are null or not null is indeterminable.  
(5) all of them are null.



28. Galileo's Law is an empirical generalization but Newton's Law of Gravitation is a theoretical generalization because,

- (1) Newton's Law is more accurate than Galileo's.  
(2) Newton's Law is more general than Galileo's.  
(3) Galileo's Law is more simple than Newton's.  
(4) Newton's Law has non-observational concepts while Galileo's Law hasn't.  
(5) Newton's Law goes beyond Galileo's law.

29. Out of the given list, which of the following rules of inference is used in the proof of the theorem  $(P \vee \sim P)$ ?

- (1) Double negation (2) Addition (3) Adjunction  
(3) Modus ponens (5) Modus tollens

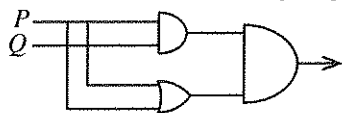


30. The three stages in evolution of human knowledge that August Comte saw were  
 (1) Thesis – Anti thesis – Synthesis  
 (2) Aesthetic – Moral – Religious  
 (3) Theological – Metaphysical – Positivist  
 (4) Oral – Anal – Genital  
 (5) Sense – Reason – Understanding
31. Which of the following fallacies is **not** considered a fallacy of irrelevance?  
 (1) Appeal to pity (2) Appeal to force  
 (3) Argument from ignorance (4) Petitio principii  
 (5) Appeal to authority
32. When compared with the research in the Natural Sciences, a limitation in the research in the Social Sciences, in general, is that it does **not** engage in  
 (1) empirical research. (2) scientific research.  
 (3) experimental research. (4) theoretical research.  
 (5) objective research.
33. What is the symbolization of the sentence,  
 “Those who are graduates only wear the cloak.” using the scheme of abbreviation  
 F:  $a$  is a graduate, G:  $a$  wears the cloak?  
 (1)  $\forall x (Fx \wedge Gx)$  (2)  $\wedge x (Gx \rightarrow Fx)$  (3)  $\wedge x (Fx \rightarrow Ga)$   
 (4)  $\wedge x (Fx \rightarrow Gx)$  (5)  $\wedge x (\sim Gx \rightarrow \sim Fx)$
34. The deductive methodologies outline how a scientific generalization is  
 (1) discovered. (2) tested. (3) verified. (4) falsified. (5) analysed.
35. What is logically equivalent to the symbolic sentence  $(P \leftrightarrow Q)$ ?  
 (1)  $(P \rightarrow Q) \wedge (\sim Q \rightarrow P)$  (2)  $(P \vee Q) \wedge (Q \rightarrow P)$   
 (3)  $(P \wedge Q) \rightarrow (\sim P \wedge \sim Q)$  (4)  $(P \rightarrow Q) \wedge (Q \rightarrow \sim P)$   
 (5)  $(P \wedge Q) \vee (\sim P \wedge \sim Q)$
36. Which of the following gives the proper sequence of situations outlined in Thomas Kuhn’s account of the process of any science?  
 (1) pre-science, crisis, paradigm, anomalies, normal science, revolution  
 (2) revolution, crisis, normal science, anomalies, paradigm, pre-science  
 (3) pre-science, revolution, normal science, crisis, anomalies, paradigm  
 (4) paradigm, pre-science, normal science, revolution, crisis, anomalies  
 (5) pre-science, paradigm, normal science, anomalies, crisis, revolution
37. (a) 2, 3, 3, 4, 4, 5, 5, 4, 6, 6, 7, 5, 5, 8, 5  
 (b) 3, 5, 7, 9, 1, 11, 18, 22  
 (c) 2, 3, 3, 4, 3, 6, 7, 8, 8, 9, 3  
 What are the modes of the three arrays of data given above?  
 (1) (a) 5 (b) none (c) 3.  
 (2) (a) 4 and 5 (b) 8 (c) 3 and 8.  
 (3) (a) 4 and 5 (b) none (c) 5.  
 (4) (a) 5 (b) none (c) 3 and 8.  
 (5) (a) 5 (b) 5 (c) 8.
38. Which is the correct truth table line for the argument  $(P \vee Q) \cdot (R \rightarrow \sim Q) \cdot Q \therefore P$ , when the indirect truth table method is used to test its validity?  
 (1) FTTT FTF TTT FFF  
 (2) TTFT FTT TTF TF  
 (3) TTFT FTT TTF FF  
 (4) TTFT FTT TTF FT  
 (5) TTFT FTT FTF FF

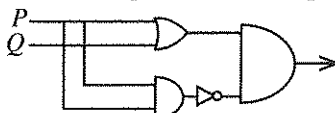
39. Carl Hempel states that the Covering Law Model of Explanation (Deductive Nomological Explanation) gives the structure of explanation in social sciences as well but that the explanations given in the social sciences are mostly,

- (1) teleological. (2) functional. (3) probabilistic-statistical.  
(4) Ideological. (5) causal.

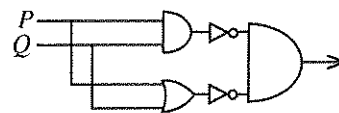
40. Which of the following logic gates could represent the expression  $\sim (P \leftrightarrow Q)$ ?



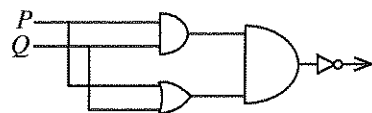
(1)



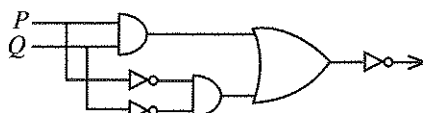
(2)



(3)



(4)



(5)

41. What the discovery of Neptune confirmed was that the initial conditions used in the derivation of the orbit of Uranus

- (1) were not all true.  
(2) had used some false data.  
(3) were not exhaustive of the relevant data.  
(4) were irrelevant.  
(5) were not accompanied by a sufficient number of auxiliary hypotheses.

42. If T = Tautology, C = Contradiction,

N = Neither a tautology nor a contradiction,

Then the expressions,  $P \rightarrow (P \vee P)$ ,  $(P \rightarrow \sim P)$ ,  $P$  have the following characteristics in the respective order

- (1) T, C, T (2) T, C, N (3) N, C, T (4) C, T, N (5) T, N, C

43. About 70 years back, a leading Newspaper Office conducted a last minute opinion poll by telephone to predict the result of a Presidential Election in a powerful country. The poll was conducted by recording the preferences of voters using the telephone. The poll predicted a win for the more conservative candidate but at the elections the predicted candidate lost. It was realized later that the prediction went wrong due to a methodological error. What was it?

- (1) The pollster did not take into account that in an advanced country the more progressive candidate would be favoured by the voter.  
(2) the questionnaire of the pollster was not properly designed.  
(3) The sample of the population selected for interviews using telephone subscribers was liable to be not fair.  
(4) The poll did not take into account that the winning candidate was already the incumbent President seeking a second term and hence was in an advantageous position.  
(5) Those who conducted the poll had not been properly trained.

44. A candidate sitting for the G.C.E.(A/L) examination paper in Logic and Scientific Method some years back tried to show that the argument.

$$\forall x Fx \therefore \Delta x Fx$$

is valid by the following derivation.

- |                                  |         |
|----------------------------------|---------|
| 1. <del>Show</del> $\Delta x Fx$ |         |
| 2. $\forall x Fx$                | Premise |
| 3. $Fy$                          | 2, EI   |
| 4. <del>Show</del> $\Delta y Fy$ |         |
| 5. $Fy$                          | 3, R    |
| 6. $Fx$                          | 4, UI   |

In which line did the candidate make the first false move?

- (1) 2 (2) 3 (3) 4 (4) 5 (5) 6

[see page seven]

45. In modern logical analysis, the sentence, 'All crows are black.' is interpreted as
- (1) a simple proposition.
  - (2) a hypothetical proposition.
  - (3) a disjunctive proposition.
  - (4) an existential proposition.
  - (5) a conjunctive proposition.
46. Which of the following positions is subscribed to by relativist thinkers in the methodology of science?
- (1) Linear growth of scientific knowledge
  - (2) Successive paradigms in science are consistent
  - (3) Theoryladenness of observation language
  - (4) When theory succession takes place the preceding paradigm could be reduced to the succeeding paradigm.
  - (5) The possibility of crucial tests between successive theories
47. Which of the following is a theorem?
- (1)  $((P \vee Q) \rightarrow P)$
  - (2)  $(P \rightarrow (P \wedge Q))$
  - (3)  $(\forall x Fx \rightarrow \wedge x Fx)$
  - (4)  $(\wedge x (Fx \rightarrow Gx) \rightarrow (\forall x Fx \rightarrow \forall x Gx))$
  - (5)  $(P \vee Q) \leftrightarrow (P \leftrightarrow Q)$
48. The sentence, 'May there be peace in Sri Lanka' is
- (1) true, as there is peace in Sri Lanka at the moment.
  - (2) false, as there is no peace in Sri Lanka at the moment.
  - (3) a half-truth
  - (4) neither true nor false.
  - (5) eternally true, for, we can never give up that hope of peace.
49. If you are given that  
 "None but a fool would commit suicide" and you know that this particular person Somapala committed suicide,  
 which of the following conclusions can you reach?
- (1) All are fools.
  - (2) Either you are not a fool or you commit suicide.
  - (3) There are some fools.
  - (4) One's being a fool and one's committing suicide are equivalent.
  - (5) There are no fools who do not commit suicide.
50. The original know-how of some of the technologies that were developing in Europe at the time of the scientific revolution had probably come to Europe through trade routes from
- (1) United States of America
  - (2) Japan.
  - (3) Russia.
  - (4) China.
  - (5) Persia.

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Department of Examinations Sri Lanka

Department of Examinations Sri Lanka



## පැරණි නිර්දේශය/பழைய பாடத்திட்டம் / Old Syllabus

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව  
 இலங்கைப் பரீட்சைத் திணைக்களம் இலங்கைப் பரීட்சைத் திணைக்களம் இலங்கைப் பரීட்சைத் திணைக்களம் இலங்கைப் பரීட்சைத் திணைக்களம் இலங்கைப் பரීட்சைத் திணைக்களம்  
 Department of Examinations, Sri Lanka  
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අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2019 අගෝස්තු  
 கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2019 ஓகஸ்ட்  
 General Certificate of Education (Adv. Level) Examination, August 2019

නර්ක ශාස්ත්‍රය හා විද්‍යාත්මක ක්‍රමය II  
 அளவையியலும் விஞ்ஞானமுறையும் II  
 Logic and Scientific Method II

24 E II

09.08.2019 / 1400 - 1710

පැය තුනයි  
 மூன்று மணித்தியாலம்  
 Three hours

අමතර කියවීමේ කාලය - මිනිත්තු 10 යි  
 மேலதிக வாசிப்பு நேரம் - 10 நிமிடங்கள்  
 Additional Reading Time - 10 minutes

Use additional reading time to go through the question paper, select the questions and decide on the questions that you give priority in answering.

## Instructions:

\* Answer only **eight** questions selecting **four** questions from each of the Parts I, and II.

N.B. \* Logical constants used in this paper are the following:

Negation:  $\sim$ , Implication:  $\rightarrow$ , Conjunction:  $\wedge$ , Disjunction:  $\vee$ , Biconditional (Equivalence):  $\leftrightarrow$   
 Universal quantifier :  $\forall$ , Existential quantifier :  $\exists$

\* Candidates are advised **not** to use any other logical constants.

\* Candidates should **not** use theorems (e.g. De Morgan's theorem) in the derivations except when the theorem itself has been proved by the candidate.

## Part I

1. (a) (i) What is the immediate inference of conversion?  
 (ii) Which of the Aristotelian categorical propositions have conversions without limitations. (04 marks)
- (b) Determine whether the following syllogisms are valid or invalid. When the syllogism is invalid, state the rule/rules violated and name the fallacy/fallacies that result.
  - (i) No astronauts are over fifty years of age.  
 Anyone over fifty years of age is mature.  
 Therefore, no astronaut is mature.
  - (ii) Some terrorists strike.  
 Those who strike are hit back.  
 Therefore, terrorists are hit back. (06 marks)
2. (a) Symbolize the following argument giving your scheme of abbreviation and test it for validity by the indirect method of truth tables.  
 Although Nimalee and Madusha are clever, either of them is not of good behaviour. Nimalee will not get the job unless her behaviour is good. If Nimalee does not get the job then she and Madusha go abroad. Therefore Madusha goes abroad. (04 marks)
- (b) Symbolize the following argument stating your scheme of abbreviation using P, Q, R, ..... to symbolize the simple sentences in the order of occurrence of them in the argument and show it to be valid by derivation.  
 If and only if Mahadanamutta was wise he was clever. He was clever but he broke the wall of the house and got into Gamarala's house on the elephant. He got the goat's neck cut and ordered breaking the pot and finally he got the goat's head out! The fact that he broke the wall of the house and got the goat's neck cut implies that he is a fool. If he is a fool then he is not wise. Therefore, we live in a mad world. (06 marks)

[see page two]

3. (a) State Popper's demarcation criterion between scientific and non-scientific statements and clarify the conditions that he lays down for a statement to be scientific. (04 marks)
- (b) "Social sciences are not falsifiable in the Popperian sense." Discuss this statement taking into consideration questions of meaning, prediction and test in the social scientific research. (06 marks)
4. (a) Outline the role of instruments in scientific research. (04 marks)
- (b) Discuss the distinction between pure science and applied science. Could the empirical investigations of social problems like suicide done in countries like Sri Lanka be considered both pure science and applied science? (06 marks)
5. (a) Symbolize the following argument giving your schemes of abbreviation and determine its validity/invalidity using the method of truth trees.  
If Sherlock Holmes overslept or Watson was indecisive then the criminal escapes to South America. The criminal did not escape to South America. Therefore, Sherlock Holmes did not oversleep. (04 marks)
- (b) Draw logic gates for the expressions  
(i)  $((P \rightarrow Q) \leftrightarrow P)$   
(ii)  $((P \rightarrow \neg Q) \rightarrow (\neg P \rightarrow R))$  (06 marks)

### Part II

6. (a) "Models play a significant role in scientific research." Substantiate. (06 marks)
- (b) "Science game is an interplay between empirical investigation and theoretical activity." Comment. (05 marks)
- (c) "Absolutely uninterpreted data and absolutely unprejudiced scientists are illusions. There can only be relatively uninterpreted data and relatively unprejudiced scientists." Do you agree? (04 marks)
7. (a) What is the classical definition of probability? What is the probability of number three showing up on both dice when two dice are thrown? (03 marks)
- (b) Explain the concepts of standard deviation and variance.  
What is the advantage that standard deviation has over mean deviation?  
Calculate the mean deviation and the standard deviation of the values 4, 5, 6, 8, 9 and illustrate. (06 marks)
- (c) Why is sampling necessary in research?  
A survey on the economic conditions in a Mahavali colony needs to select a sample of 50 people from the colony population of 500 families for interviews. You are provided with a list of the heads of the families, a voters list of 1400 voters and a telephone directory of 200 land-phone subscribers. Discuss the risks in using each of the lists in selecting your random sample of 50 and indicate what choice and procedure you would adopt. (06 marks)

8. (a) Symbolize the following arguments in terms of classes giving your scheme of abbreviation and determine their validity using Venn diagrams.

- (i) No vehicles are unregistered.  
No marriages are unregistered.  
Therefore some marriages are vehicles.

- (ii) All children are lovable.  
Some children are naughty.  
Therefore some naughty ones are lovable. (06 marks)

(b) Symbolize the following argument, giving your schemes of abbreviation and show it to be valid by the method of derivation.

- All men are ambitious.  
Some men are businessmen.  
Therefore some ambitious are businessmen. (05 marks)

(c) Symbolize the following sentences, giving your schemes of abbreviation

- (i) That neither did the member of parliament come to the parliament nor did he vote is a false statement.

- (ii) Out of A and B only one wins the election. (04 marks)

9. (a) Prove the following theorems.

(i)  $(P \rightarrow (Q \wedge R)) \rightarrow ((P \wedge Q) \leftrightarrow (P \wedge R))$

(ii)  $(\sim \forall x Fx \leftrightarrow \Delta x \sim Fx)$

(iii)  $\forall x Fx \leftrightarrow \forall y Fy$  (09 marks)

(b) Write notes on the followings.

- (i) dilemmas,  
(ii) ordinary language and the use of symbolic language in Logic. (06 marks)

10. Write notes on **three** of the following:

- (i) Lakatos' Methodology of Scientific Research Programmes  
(ii) Technology and Future-life on Earth-whither are we bound?  
(iii) Ethical codes for professions and their implementation

(05 × 3 = 15 marks)

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